

SECTION EXPECTATIONS

- Analyze and illustrate the electric field produced by various charge arrangements and two oppositely charged parallel plates.
- Describe and explain the electric field that exists inside and on the surface of a charged conductor.
- Analyze and explain the properties of electric fields.

KEY TERMS

- charge density
- gradient
- potential gradient
- Stokes' Law
- Millikan's oil-drop experiment

In Chapter 7, Fields and Forces, you learned about electric fields and studied a few special cases of fields, such as the electric field around a single point charge and the combination of two point charges, either like or unlike. Much more complex fields exist, however, both natural and generated in the laboratory. For example, Figure 8.1 shows areas of equal potential around the human heart.

In this section, you will be studying the electric field and the corresponding field line patterns of a number of different-shaped, charged conductors. Regardless of how many individual charges are included in the configuration, the electric field vector at any point can be determined by calculating the sum of electric field vectors contributed by each charge influencing the field. For some configurations, however, this method would become very tedious and time-consuming, so physicists have developed techniques for a few special cases of fields. In addition, computer programs have been developed that can generate the field lines for different arrangements of charges. The user can create the distribution of charges and the computer will generate the associated electric field lines.

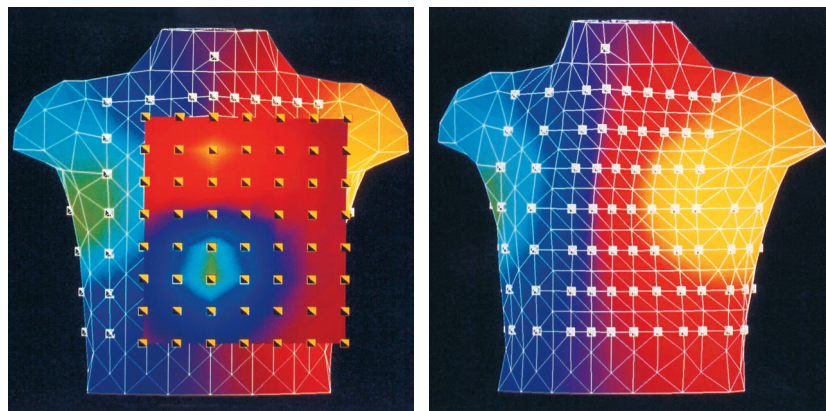


Figure 8.1 Electric and magnetic fields are a very real part of life. The photo on the right shows areas of equal electric potential difference, while the photo on the left shows areas of equal magnetic field intensity and direction around the human heart in varying shades of colour. The electric activities of the heart can provide a physician with important information about the health of a patient's heart.

WEB LINK

www.mcgrawhill.ca/links/physics12

If you would like to experiment with creating charge distributions and generating field lines, go to the above Internet site and click on **Web Links**.

Properties of an Electric Field Near a Conductor

Until now, you have been considering fields in the region of point charges. As you will see in the following Quick Lab, you can create some unusual fields with point charges. In real situations,